

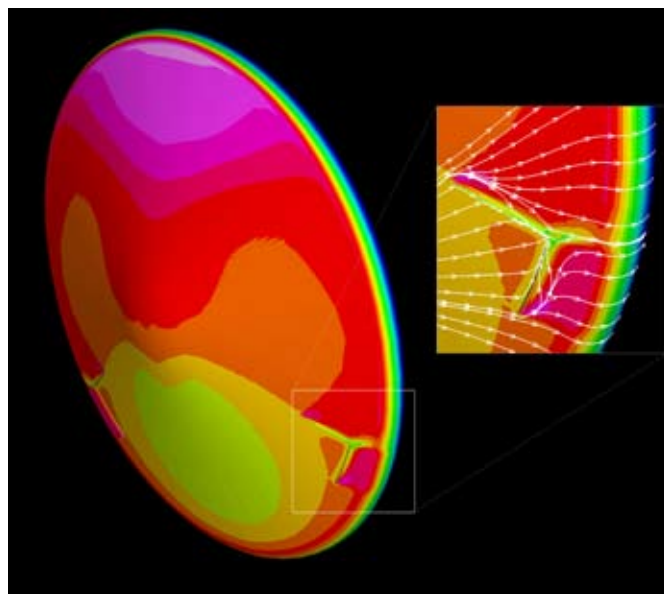
Space Travel

Aerothermal Analysis in Support of the Mars Science Laboratory Project

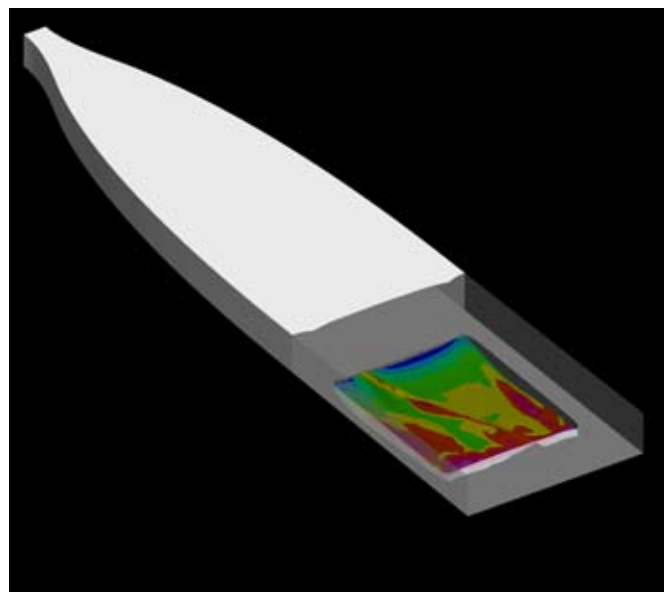
The Mars Science Laboratory (MSL) is a flagship-class rover mission scheduled for launch in winter 2011. The purpose of this project is to provide computational fluid dynamics (CFD) analyses using the Data-Parallel Line Relaxation (DPLR) code to support the design, testing, and qualification of the thermal protection system that will protect the spacecraft from Mars' harsh entry environment.

Dozens of CFD simulations of both flight and arc-jet environments were computed on NASA's Columbia supercomputer to support the MSL project. These results successfully demonstrated adequacy of the Phenolic Impregnated Carbon Ablator (PICA) heatshield for the MSL mission. Although the mission has been delayed, all elements of the aeroshell thermal protection system (TPS) were designed, tested, and built in time to support the original launch date.

Use of Columbia was an enabling capability for this work. Due to the extremely schedule-driven nature of the MSL project, it was only with priority access to Columbia that we were able to perform the necessary aerothermal analysis to support the design, testing, and qualification of the thermal protection system within the tight time constraints.



Temperature contours on the Mars Science Laboratory heatshield with gap-filler protuberances.



Temperature contours of the Turbulent Flow Duct simulation for a recessed Phenolic Impregnated Carbon Ablator specimen.